

WHAT IS CLAIMED IS:

1. A finger operating in chip-rate, comprising:

a descrambling means that descrambles base-band received signals by using frame timing information;

a first pilot retrieving means for retrieving a pilot signal that is to be used as input of a weight vector computing means to compute the weight vector;

the weight vector computing means that produces the weight vector by using signals from the descrambling means and the first pilot retrieving means;

a general weighting means for producing a general weighted signal, by compensating phase delay of the base-band received signal with the weight vector;

a second pilot retrieving means for retrieving the pilot signal that is to be used to compensate path delay, by using outputs of the general weighting means and a PN-code;

a Walsh despreading means for providing received data for each of traffic channels, by using outputs of the general weighting means, the PN-code, and corresponding Walsh codes; and

a channel compensation means for compensating phase distortion caused by the path delay to each output of the Walsh despreading means, by using output of the second pilot retrieving means.

2. The finger according to claim 1, further comprises a tracking means for producing a frame tracking information that is used to compensate small changes of the path delay.

3. The finger according to claim 2, wherein the tracking means produces the frame tracking information from difference between two energies which are obtained by integrating results of early and late descrambling wherein a first and a second synch time information are used, respectively.

4. The finger according to claim 2, wherein the tracking means produces the frame tracking information from difference between two energies which are obtained by squaring weighted sums of integrations of descrambled signals provided through early and late descrambling wherein a first and a second synch time information are used, respectively.

5. The finger according to claim 2, wherein the tracking means produces the frame tracking information from difference between two energies which are obtained by squaring results of integrations of weighted sums between the weight vector and descrambled signals provided through the early and late descrambling wherein a first and a second synch time information are used, respectively.

6. The finger according to claim 3, wherein the tracking means produces the frame tracking information from difference between two energies which are obtained by integrating results of the early and late descrambling wherein the first and the second synch time information are used, respectively, such the frame tracking information is produced after filtering the difference between the two energies.

7. The finger according to claim 4, wherein the tracking means produces the frame

tracking information from difference between two energies which are obtained by integrating results of the early and late descrambling wherein the first and the second synch time information are used, respectively, such the frame tracking information is produced after filtering the difference between the two energies.

8. The finger according to claim 5, wherein the tracking means produces the frame tracking information from difference between two energies which are obtained by integrating results of the early and late descrambling wherein the first and the second synch time information are used, respectively, such the frame tracking information is produced after filtering the difference between the two energies.

9. The finger according to claim 3, wherein the first synch time information for the early descrambling is earlier than the frame timing information by about 0.2 to 0.5 chip duration while the second synch time information for the late descrambling is later than the frame timing information by about 0.2 to 0.5 chip duration.

10. The finger according to claim 4, wherein the first synch time information for the early descrambling is earlier than the frame timing information by about 0.2 to 0.5 chip duration while the second synch time information for the late descrambling is later than the frame timing information by about 0.2 to 0.5 chip duration.

11. The finger according to claim 5, wherein the first synch time information for the early descrambling is earlier than the frame timing information by about 0.2 to 0.5 chip

duration while the second synch time information for the late descrambling is later than the frame timing information by about 0.2 to 0.5 chip duration.

12. The finger according to claim 1, wherein the descrambling means multiplies the received signal in digital state(I_{rx} , Q_{rx}) with a local PN-code using a finger timing information (f_{timing}) provided from outside finger.

13. The finger according to claim 1, wherein the first pilot retrieving means retrieves the pilot signal to be used as input of weight vector computing means by integrating output (y vector signal) of the descrambling means for preset period of time.

14. The finger according to claim 13, wherein the weight vector computing means produces the weight vector ($Weight_I$, $Weight_Q$) using the x_{vector} signal and the y_{vector} signal.

15. The finger according to claim 14, wherein the weight vector computing means is reset to initial state upon reception of frame reset signal (f_{reset}) which is generated by finger death signal (f_{death}) when the PN-code acquisition is lost such that PN-code acquisition for lost path can be restarted with initial state.

16. The finger according to claim 1, wherein the general weighting means produces the general weighted signal, by compensating phase delay of the base-band received signal with the weight vector.

17. The finger according to claim 1, wherein the Walsh despreading means includes:

FCH (fundamental channel) despreading means for retrieving data transmitted through FCH (fundamental channel) by multiplying result of the descrambling of an array output with the Walsh code corresponding to the FCH;

DCCH (dedicated control channel) despreading means for retrieving data transmitted through DCCH (dedicated control channel) by multiplying result of the descrambling of the array output with the Walsh code corresponding to the DCCH;

SCH 1 (Supplemental channel 1) despreading means for retrieving data transmitted through SCH 1 by multiplying result of the descrambling of the array output with the Walsh code corresponding to the SCH 1; and

SCH 2 (Supplemental channel 2) despreading means for retrieving data transmitted through SCH 2 by multiplying result of the descrambling of the array output with the Walsh code corresponding to the SCH 2.

18. The finger according to claim 17, wherein the channel compensating means is located for compensating the phase distortion due to path delay associated with each of traffic channels the FCH, the DCCH, the SCH 1, and the SCH 2.

19. The finger according to claim 18, wherein the tracking means, for providing exact chip synchronization through the fine-tuning of PN-code acquisition, includes:

first complex descrambling means for multiplying the received signal with the PN-code of 1/2 chip advanced time to the f_{timing} ;

second complex descrambling means for multiplying the received signal with the PN-code of 1/2 chip retarded time to the f_{timing} ;

first and second energy estimation means for providing correlation energies by integrating results of the early descrambler and late descrambler, respectively; and

tracking information (f_{trk}) generating means for providing the tracking information (f_{trk}) by comparing magnitudes of results of the first and second energy estimation means.

20. A demodulation apparatus that uses fingers operating in chip-rate for mobile communication system comprising:

an analog-to-digital converter (ADC) for converting analog signal, which has been frequency-down converted to base-band, to corresponding digital signal through oversampling procedure;

a searcher for transmitting a searcher-energy that exceeds preset threshold value to lock detector while the searcher-energy is computed through correlation procedure between output of the ADC and a PN-code corresponding to pilot channel;

a lock detector for generating signals needed for accurate frame synchronization including frame reset information (f_{reset}), frame timing information (f_{timing}), frame death information (f_{death}) using the correlation energy provided from the searcher; and

at least one finger for weighting in chip-rate traffic channel signals with weights which are obtained from the received data in the pilot channel of the reverse link.

21. The demodulation apparatus according to claim 20, wherein the finger

comprises:

a descrambling means for descrambling received signals given in base-band from the ADC with the local PN-code by using frame timing information;

a first pilot retrieving means for retrieving a pilot signal that is to be used as input of a weight vector computing means to compute the weight vector;

the weight vector computing means that produces the weight vector by using signals from the descrambling means and the first pilot retrieving means;

a general weighting means for producing a general weighted signal, by compensating phase delay of the base-band received signal with the weight vector;

a second pilot retrieving means for retrieving the pilot signal that is to be used to compensate path delay, by using outputs of the general weighting means and a PN-code;

a Walsh despreading means for providing received data for each of traffic channels, by using outputs of the general weighting means, the PN-code, and corresponding Walsh codes; and

a channel compensation means for compensating phase distortion caused by the path delay to each output of the Walsh despreading means, by using output of the second pilot retrieving means.

22. The demodulation apparatus according to claim 21, wherein the finger further comprises a tracking means that produces a frame tracking information for compensating small changes in path delay.

23. The demodulation apparatus according to claim 20, wherein the searcher

comprises:

a received signal processing means for achieving envelope detection of the received data such that the correlation energy to be obtained at each antenna channel;

an adding means for summing up the correlation energies at each of antenna channels obtained from the received signal processing means; and

an output means for generating result of the adding means as final output of non-coherent detection.

24. The demodulation apparatus according to claim 23, wherein the received signal processing means comprises:

a first arithmetic means for computing magnitude of the correlation energy at each antenna channel by adding results of square of processing results along I-channel and Q-channel; and

a second arithmetic means for summing up results of computed magnitude of the correlation energy at each of antenna channels.

25. A demodulation method using fingers that operates in chip-rate for mobile communication system, comprising:

a first step of descrambling received signal by multiplying a PN-code with a received signal using frame timing information (f_{timing});

a second step of generating a pilot signal obtained by integrating a descrambled signal in order to use it for computing weights;

a third step of computing a weight vector using the descrambled data and the pilot

signal;

a fourth step of generating an array output by summing up the results of multiplication between the weight vector and the received signal in such a way that inter-element phase difference be compensated;

a fifth step of generating the pilot signal for compensating phase distortion due to channel delay by integrating result of the multiplication of the PN-code and the array output;

a sixth step of separating each channel signal from the array output through the Walsh despreading procedure; and

a seventh step of compensating a phase distortion due to a channel delay by applying the pilot signal to each channel signal which has been obtained through the Walsh despreading procedure.

26. The demodulation method according to claim 25, wherein the fourth step of generating the array output and the fifth step of retrieving the pilot signal for compensating phase distortion is performed in a single step.

27. A computer-readable recording medium for recording a program that embodies the method using fingers operating in chip-rate, comprising:

a first function of descrambling a received signal by multiplying a PN-code to the received signal using frame timing information;

a second function of generating the pilot signal as input of computing a weight vector by integrating a descrambled signal;

a third function of computing the weight vector by using the descrambled signal and the pilot signal;

a fourth function of generating an array output by first multiplying the received signal by a weight vector and then summing up results of multiplications of the received signal and the weight vector;

a fifth function of retrieving the pilot signal for compensating phase distortion due to path delay by integrating multiplication of the PN-code and the array output;

a sixth function of separating the array output into each of traffic channel signals through the Walsh despreading; and

a seventh function of compensating the each traffic channel data despreaded through the sixth function using the pilot signal retrieved through the fifth function.